TITLE OF THE INVENTION

SPACE KEYBOARD SYSTEM USING FORCE FEEDBACK AND METHOD OF INPUTTING INFORMATION THEREFOR

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of Korean Application No. 2001-10017, filed February 27, 2001, in the Korean Industrial Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to an information input system, and more particularly, to a space keyboard system, which informs a user whether or not a character is input using a force feedback method, and a method of inputting information therefore.

2. Description of the Related Art

[0003] In the prior art, an information processing apparatus, such as a computer, uses a keyboard for inputting commands, characters, and numbers. A conventional information input apparatus using the keyboard, as shown in FIG. 1, includes a key unit 110 having keys, a control unit 120 for detecting a plurality of keys being pushed and decoding signals thereof, and a computer system 130 for displaying a character corresponding to the decoded signal .

[0004] This conventional keyboard is generally connected to a desktop computer and is not appropriate for a wearable or portable system. Therefore, to solve this problem, a keyboard that can be used in any space is currently under development. However, even when a keyboard is desired to be implemented in a virtual space, a user may not directly sense whether characters input through the motion of the user's fingers are correctly input. Also, the user may become fatigued or physically tired since the user inputs characters by viewing the screen of the computer .

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide a space keyboard system, in which, when a character is input in response to the motion of a user's finger, force is applied to a predetermined part of the finger so that the user can confirm that a character is input, and a method for inputting information thereof.

[0006] Additional objects and advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0007] To accomplish the object of the present invention, there is provided a space keyboard system comprising a sensor unit that is attached to a predetermined part of a finger which senses motion information of the finger, an information input processing unit which interprets modulated data of the motion information of the finger, displays a character corresponding to a location of the finger with respect to a virtual keyboard in space, determines the finger corresponding to the displayed character, and generates an input completion signal having an identifier of the determined finger, a processor unit which converts the finger motion information detected by the sensor unit into converted data, modulates the converted data, sends the modulated data to the information input processing unit, and receives the input completion signal of an input character from the information input processing unit, and a force generating unit that is attached to a predetermined part of the finger which applies force to the finger corresponding to the input completion signal if the input completion signal is received.

[0008] In another embodiment, the present invention provides a space keyboard system for inputting information in space, the space keyboard system comprising: a sensor unit that is attached to a predetermined part of a finger which senses motion information of the finger, a processor which determines a location of the finger with respect to a virtual keyboard in space on the basis of the finger motion information detected by the sensor unit, sends the location information to a computer and receives an input completion signal identifying the finger corresponding to the character input from the computer, and a force generating unit that is attached to a predetermined part of the finger which applies force to the finger corresponding to the input completion signal if the input completion signal is received.

[0009] To accomplish the above and other objects of the present invention, there is provided a method of inputting information in space, comprising providing a sensor unit generating an acceleration and/or angle signals to a first predetermined part of a finger, providing a force generating unit to a second predetermined part of the finger, detecting a motion of the finger with the sensor unit, interpreting the motion information detected and determining a location of the finger with respect to a virtual keyboard in space, and inputting a character corresponding to the location of the finger that is determined and applying the force to the finger with the force generating unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The above objects and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIG. 1 is a block diagram of an information input system for inputting information through a conventional keyboard;

FIG. 2 is a preferred embodiment of a space keyboard system according to the present invention;

FIG. 3 is a block diagram showing the space keyboard system according to the present invention; and

FIG. 4 is a flowchart of a method for inputting information in a virtual space according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] Reference will now be made in detail to the present preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

[0012] First, to implement the present invention, it is assumed that there is a virtual keyboard in space. That is, a manufacturer may set the virtual keyboard in space

before the product is shipped, or a user may set the virtual keyboard in a desired location in space from the computer. Also, through a training process, the user can input information from a predetermined location in space.

[0013] FIG. 2 is an embodiment of a space keyboard system according to the present invention. Referring to FIG. 2, an information input apparatus is formed with sensors 220, force-generating units 210, and a processor 230 in each hand. The sensors 220 are attached to each finger of both hands, and sense the motion of the fingers. As an embodiment of the sensors 220, an acceleration sensor may be used. The force-generating units 210 are attached to each finger and correspond with the sensors 220 and generate force to a predetermined part of the fingers. A device capable of generating a force, vibration or a small electric shock is preferably used as the force-generating unit 210. The processor 230 is located on the back of a hand or on a wrist and communicates information with the sensors 220 and the force generating units 210. As shown in FIG. 2, the sensors 220 and the force generating units 210 are preferably located at the end of each finger. However, the sensors 220 and the force generating units 210 may be located at any part of the finger.

[0014] Motion information of the finger detected by the sensor 220, for example, acceleration information and/or angle information, are sent by wire or wirelessly to an information input processing apparatus, such as a computer, and converted into location information in the information input processing apparatus. Then, referring to the location information, the information input processing apparatus displays a character, which is selected by a user finger, on a display unit 240. At the same time, an input completion signal of the selected character is fed back by wire or wirelessly to the force-generating unit 210 attached to the corresponding finger. At this point, the user is able to confirm, through the force given to the corresponding finger, that the information is actually input.

[0015] The location information of a finger can be determined by processing acceleration information and/or angle velocity information using a sensor, such as a gyro sensor or an inertial micro-electro mechanical system (IMEMS) sensor, which transforms the acceleration and/or angle velocity information into an electrical signal. For example, all five of a user's fingers may have an IMEMS sensor which generates electrical signals in response to motion of the user's fingers and/or hand. If the user moves one of the fingers (i.e. up to down corresponding to a selection of a character)

more than the other fingers, the electrical signal of that finger is the strongest. A processor can determine the location of the fingers corresponding to a particular motion using motion information generated by each of the sensors.

[0016] FIG. 3 is a block diagram showing the space keyboard system according to the present invention. Referring to FIG. 3, a sensor 310 outputs motion information of a finger as acceleration information and/or angle information in an analog or digital signal form. A processor 320 converts the finger motion information detected by the sensor 310 into data having a predetermined form, sends the data to an information input processing apparatus 340, and receives an input completion signal identifying the finger corresponding to a character which is input from the information input processing apparatus 340.

[0017] More specifically, an analog-to-digital converter (ADC) 324 in the processor 320 converts the motion information generated by the sensor 310 into a digital signal from an analog signal. A digital board 326 converts the motion information output from the ADC 324 into the converted data having the predetermined form, which can be used by the information input processing apparatus 340, and outputs the received input completion signal to the force-generating unit 330 of the corresponding finger. A communications module 328 modulates the converted data having the predetermined form from the digital board 326, and sends the modulated data to the information input processing apparatus 340 by wire or wirelessly. The communication module 328 also demodulates the input completion signal received from the information input processing apparatus 340.

[0018] The information input processing apparatus 340 interprets the modulated data (finger motion information) sent by the processor 320 and generates a character corresponding to the location of the finger with respect to a virtual keyboard in space. The information input processing apparatus 340 determines the finger corresponding to the generated character and outputs the input completion signal having an identifier (ID) of the finger, with which the character was input, for the force-generating unit 330 corresponding to the location of the identified finger.

[0019] The software 350 is a program for driving the information input processing apparatus 340, so that the space keyboard is managed.

[0020] In another embodiment of the present invention, the motion information detected by the sensor 310 may be directly output to the force-generating unit 330 so that the user can confirm the input of a character.

[0021] In still another embodiment of the present invention, the functions of the processor 320 and of the information input processing apparatus 340 may be set differently. That is, after interpreting the motion information detected by the sensor 310, the processor 320 determines the location of the finger with respect to a virtual keyboard in space, sends the location information to the information input processing apparatus 340, and receives an input completion signal from the information input processing apparatus 340. The information input processing apparatus 340 inputs a character on the basis of the received finger location information, generates the input completion signal having an identifier of the finger, and sends the input completion signal corresponding to the character input based on the location information of the finger to the processor 320 .

[0022] In still another embodiment of the present invention, the processor 320 interprets finger motion information detected by the sensor 310 and may directly output the input completion signal to the force generating unit 330.

[0023] FIG. 4 is a flowchart of a method of inputting information in a virtual space according to the present invention. First, the sensor 310 and the processor 320 are initialized in step 410.

[0024] Then, a determination is made as to whether or not a user termination signal is detected in step 420. If the user termination signal is detected, information processing is finished. If the user termination signal is not detected, the sensor 310 in step 430 detects finger motion information . The detected finger motion information is converted into data having a predetermined form, which can be used by the information input processing apparatus 340 in step 440. After interpreting the converted motion information in step 450, the location of the finger with respect to a virtual keyboard in space is determined based on the interpreted information in step 460. Using the sensor 310 in step 470, it is determined whether the motion information corresponding to a character selected by the finger in a virtual space is detected . If the motion is detected, the character corresponding to the location of the finger with respect to the virtual keyboard in space is input in step 480.

[0025] In step 490, the character is displayed on a screen at the same time the input completion signal is output having an identifier of the finger corresponding to the input character . Steps 420 through 490 are repeated until the user termination signal is detected in step 420.

[0026] According to the present invention as described above, when a character is input by a finger motion in space, a force is given to the end of the finger so that the user can confirm the input without watching the screen.

[0027] Although a few preferred embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.